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Hearing - 396

Of Hearing. Lect. 15th Decr 30. 17

In ~~on~~ treating of this fun[illegible]
I say a few words on the [illegible]
Sounds, and the manner in [illegible]
they are propagated.
2 I shall describe the Structure of the
Ear, and the manner in which
Sounds are conveyed by it so as to excite
Sensations in the Minds —

By Sound I mean certain tremors
or vibrations communicated ~~from~~ from a the
percussion of a sonorous body thro' ~~the~~ a
~~medium~~ connecting medium to the ~~Drum~~ Drum of
the ear thro' which a sensation is
excited in the mind. —

This ~~consequently~~ sound may be divided into two kinds, viz Sound properly so called, and Noise. By Sound I include musi=cal tones, ~~and~~ whether vocal or instru=mental, and speech. By Noise I mean ~~the~~ those coarse tones which arise from the concussion of heavy bodies on the earth, or from the explosion of gunpowder. ~~in~~

The medium which communicates sound and ~~Noise~~ noise is said to be Air. It is certainly the vehicle of Noise. We observe ~~its effects when the~~ it to be agitated by the firing of Cannon. We feel an artificial breeze created by it, &c

we see windows broken, and the walls of houses to be ~~shaken~~ shaken by it. ~~I was the~~ Betty ~~of earth~~ the earth as well of the air is the vehicle of Noise. Of this ~~the~~ enemy proofs occur in the time of war. ~~at~~ ~~late~~ During the battle of Brandywine where I attended as a Surgeon, in the year 1777. ~~I stood~~ ~~a field on which~~ about a quarter of a mile from the two armies we were engaged, ~~to be~~ I observed the surface of a field on w.h. I stood to become suddenly invisible owing to a cloud of dust which rose from it, and which stood above four feet from the ground. This appearance at first surprised me, nor did I recollect for some

V It passes with different velocities, and to a different extent thro' each opaltum.

time that it was occasioned by the concussion of the earth by the explosion of cannon and other fire arms. — During the Cannonade of ~~[illegible]~~ Mud Island eight miles below our city, a British Soldier at Easton 70 miles above their prisoner on the Delaware, one morning came into his ones city quarters & with an air of triumph he said "the city of Philadelphia was taken, for that the Cannonading had suddenly ceased." This he discovered by ~~putting~~ thrusting his knife in the ground, & placing his ear on the handle of it. In a day or two it was discovered at Easton that this Soldier was not mis=taken. — Not only the Air & Earth, but Water is a vehicle of ~~sound~~ noise.

v Dr Franklin says this noise may be heard distinctly ~~fr~~ one mile.

I have often when a boy heard the noise of two stones struck against each other ~~under water~~ with my head parallel to them at the distance of several feet under the water. Divers we are told can hear the noise of a ships before she can be discovered by the eye on ~~above~~ the water — at a much greater distance. The air is said to be the vehicle of musical and vocal tones whether musical or otherwise. — But is not this fluid too gross for the fine tones of music, and too simple for their immense variety. — may not the air like the matter of light be a compound body, & consist of as many different fluids as the matter of light does of colors, and

may not the difference we perceive in tones be occasioned by impressions conveyed to the ear by these different fluids? — I throw this out only as a conjecture. I shall still notwithstanding continue to suppose the air to be the vehicle of sound: for if it should contain even fixed fluids than itself, still it is the only one that is obvious to our senses & to experiments.]

That sound is produced by tremors or vibrations emitted by a sonorous body, ~~I infer~~ we infer from ~~observing~~ attending to a bell when struck by a hammer. Its tremors may be felt by the hand. Nay — they may be seen by the eye. [The bell in its tremors passes every

minute from an Oval to a elliptical form. — I shall now deliver a few general

Observations on Sounds. go to p. 413.

[1 The pitch of sound is in a compound ratio of the size or mass of the body which strikes & of the number of vibrations emitted by it. The more solid & elastic bodies are, the more readily they emit sound, & vice versa. hence ~~iron~~ brass & silver, & iron are more sonorous than gold or lead. —

2 Bodies are sonorous in proportion as they are more or less tense. a piece of wire held in the hand without being connected with a solid body & stretched emits no sound, — the same wire when stretched, emits sonorous vibrations.

3 all solid bodies which strike against other solid bodies, produce sound.

the body struck be inelastic, - the sound emitted will be simple, - for elastic bodies these sounds will be compound.

~~All~~ Sounds are divided into acute & grave. Nature has fixed no limits between them. Grave sounds by descending gradually become acute - while acute sounds by ascending, gradually rise into such as are grave. ~~All sonorous bodies vibrate or tremble in emitting~~ The distinction of tones is taken from the number of vibrations of a sonorous body. If there be many vibrations in a second, the sound is called an acute one, and the more the vibrations are in that time, the more acute the sound, - and on the contrary, the fewer vibrations there are in a

~~Minute~~ Second, the more grave the sound. If these vibrations become so few in a second as to be perceptible to the eye, no sound will be emitted. The celebrated Euler discovered that a ~~vibration~~ sound to be audible must consist of 30 vibrations in a second, and that when the vibrations fall below 30 there is no perceptible emission of sound. The same acute philosopher discovered further, that the highest perceptible acute tone consists of 7520 vibrations in a ~~minute~~ second. From this account of grave & acute tones you will easily see how impossible it is to draw a line between them. For ~~the~~ a tone that consists of 40 vibrations in a second is certainly a grave one,

but it is acute, compared with a tone of 30 vibrations in a second, & yet this in like=wise belongs to the class of grave tones.

It is necessary here to distinguish between the acuteness & intensity of sound tones. Intensity of tone depends on the force of percussion, and upon the number of tremulous particles in the body which is struck, and not upon the number of its vibrations. It has been remarked by Mr Saveur (Mem: de Paris of academy of 1700) that a Cord which emits a definite or limited number of tones in a second, may be made to emit sounds 72 times greater or less in degree at the same time, without varying its vibrations in the least, or its tones with regard to gravity, or acuteness. He remarked further, that

v by ~~trues of this~~ definition omitted
by ~~the~~ Ramsborn.

from time to time so gross as scarcely to be perceptible, we often observe pillars between wells to be moved. This has often been effected by a Church Organ. — ~~The wells of Jericho were supposed to have been thrown down~~

The greater or less frequency of vibrations ~~on which the difference of~~ of the differing tones has been found to depend on the following particulars 1 the length of the cord — 2nd its thickness 3rd its degree of tension 4th the matter of which the musical cord is made whether it be ~~metal~~ metal or catgutt. Two cords composed of the same materials — of equal thickness, — and equally stretched, always exact the same number of vibrations in a second. They are said in this situation to be in Unison with each other. — The more time a cord, the more acute its tones, the same

cord will often send forth acute, or ~~[illegible]~~ grave tones, from a difference in its vibrations according as it differently stretched. This has been demonstrated (by Galileus) by a very simple & beautiful experiment. ~~[illegible]~~ If you take a tumbler nearly filled with water, & rub its edges for a while with your fingers, you will soon produce a sound, and with it, you will produce a number of small waves on the surface of the water. If ~~you~~ after this you move your fingers with more rapidity around the edges of the glass, so as to exercise its vibrations & thereby to raise ~~the~~ its tone ~~of it~~ an octave higher, you will perceive the number of the waves to be increased on the water, and you will observe these last waves to form an exact line on the water with those which were first produced on it.

That which tension imparts to musical Cords, Elasticity & Solidity im=part to all bodies – hence we find the more elastic and solid bodies are, the more acute are the Sounds they send forth. If Cords equally tense, and of the same diameter, but of different lengths, emit a different number of vibrations in an inverse ratio of their lengths. If one Cord be twice as long as another, it emits tones twice as grave, – if it be half as long as another, it emits sounds twice as acute. Hence less tension, with an increase of length & thickness in a Cord, is best calculated to emit grave tones, while more tension with less length & thickness in a

Cord is best calculated to produce ~~more~~ acute tones. It is to be observed here however, that there is no Chord, or pipe so exactly toned, or so struck, as to emit one tone only. A cord when struck ~~when~~ with great force frequently emits tones of different degrees of acuteness or gravity, especially in its first Vibrations.

From the Variety in the proportion of the Number of Vibrations, musicians have introduced certain ratios of the Variety in their tones, which they have distinguished by the following names.

1 They call that Consonance, when two Cords are in Unison with each other, & send forth the same number of Vibrations in exactly the same time.

2 They call that an Octave when

a cord A ~~sends forth two of~~ suppose one foot in length, sends forth half the number of vibrations of a cord B: of two feet in length - but equal in every other or every other circumstances. ~~These~~ Vibrations second, of these two cords are in Unison with each other. This tone is called a superior Octave ~~also~~ to distinguish it from an inferior Octave which is when the Vibrations of the cord A are somewhat less. Be= =tween two Octaves, good ears can Dis= =tinguish 43 different tones.

3 They call that a fifth, when the vibrations of the cord A are in proportion ~~number~~ to the vibrations of the cord B as 3, are to 2.

4 They call that a fourth when the vibrations of the cord A are to

those of the Cord B. as 4 are to 3.

5. They call that a greater third when the vibrations of A are to those of B: as 5 are to 4, and

6 They call that a less third, When the Vibrations of A are to those of B: as 6 are 5. See, Boerhaave vol: iv p: 169.

These explanations are necessary in order to enable us to understand the meaning of Sympathy in Music, or sympathetic tremors. These occur when a single cord only is struck & which is immediately communicated to by means of a solid body or the air to a number of cords which are in Unison with it, and which all emit at the same time, the same number of

Vibrations. —

It is not necessary, ~~that~~ in order to produce this Unison of Vibration, ~~or~~ ~~in tones~~ that the im=pulse should be made on the same ~~instrument~~ kind of instruments. not only different instruments of Music, but different solid bodies ~~cannot~~ tremble together when they are in Unison with the each other. Thus for Eg a musical cord trembles with a human Voice — a glass filled with ~~full of~~ water, & rubbed with a finger, trembles the flute — a ~~pipe~~ glass, trembles with a trumpet, — and the Bag=pipe, trembles with a stroke upon a kettle drum. The same occurs to all solid bo=dies whose particles are calculated or formed to emit the same number of vibrations in the same time. —

Besides the cords which are in Unison with each other, those cords are observed to tremble less together ~~which lay~~ which are distant from each other by an octave or a fifth, than those which are distant a third, or by any of the other tones. [When they are distant from each other by an octave, and the shortest of ~~these~~ them is struck = that which is twice as long] From all these facts we learn why we feel certain vibrations ~~from~~ in our bodies excited ~~emitted~~ by certain sounds. It is because they are more or less in unison with those sounds. The painful tremors of the bones of the ear & of the teeth from the ~~noise of a filing iron~~ filing of iron are produced by the ~~shrill~~ acute sounds emitted by the iron exciting equal ~~vibrations~~ ~~equal~~ vibrations in those

But when the ~~rod~~ iron which is filled is shorter than the membrane of the ear (which is about the size of a man's nail) it emits more acute vibrations than can be returned by the membrane of the ~~ear~~ ear, & hence it is sometimes mistaken by that ungrateful sound. In like manner

Here you see that even in dead matter there is a certain relation established between stimulus & motion. It extends to the ~~moral as well as to the animate~~ & inanimate ~~world~~ as well as to the ~~inanimate~~ animated world. Nay - more - it extends to ~~moral and~~ all the operations of the human mind whether they be ~~are~~ excited to moral - intellectual - or political subjects.

parts of the body. It is remarkable that the size of the parts acted upon in & out of the body, and their ~~quality~~ matter are nearly alike. Their tremors are thereby nearly equal. Windows - doors & wooden bones sometimes tremble in ~~like manner~~ under the impression of corresponding vibrations. — The fall of the walls of Jericho recorded in the Old Testament has been ascribed to the corresponding vibrations produced by the blowing of a horn. A tone from a grave to an acute one from a human voice has by this means sometimes broken a glass cup.

That sound should be produced, tremors should be excited not only in the air, but in the body which emits it. For an acc^t of the manner in which the air is acted upon in producing sound ~~see Dr Hales on sound § 22~~ I refer you to Watts on nat philosophy.

⊙ The presence of air, as I said formerly is necessary

V ~~But~~ In order that dense air should convey sounds, it should possess at the same time elasticity. It is upon the account of the peculiar elasticity of the air in warm climates that sounds are more intense than in cold countries, ~~are towards west indies~~ notwithstanding the air in the latter is more dense than in the former. It is owing to the greater density of the earth near the surface of the earth that the noise of artillery is sometimes heard 40 leagues, while thunder is heard in the upper and over-regions of the air but two leagues. A public speaker for the same reason is heard more distinctly near the level of his hearers ~~up~~ than near the floor of a church, or the

to the production of sound. a bell struck
with a hammer in an exausted recei=
=ver sends forth no sound. — ~~The intensity~~
The degree of ~~tow~~ intensity in sound
~~of Air liberated upon sound is dependy~~
is greatly influenced by the ~~density~~
density of the Air. A pistol discharg=
=ed at the top of the spire of Lanerifffcan
scarcely be heard by the person who fires
it. Sounds are heard far easily in
cloudy & rainy, than in clear weather.
Sound is supposed to travel 1142 feet in
a second. This has enabled philosophers
to ~~disco~~ tell the exact Distance of an
thunder by counting the seconds between
the flash of the lightning, & the report
of the thunder. Against a contrary
wind sound travels according to Dr Haller
with $\frac{1}{22}$ less Velocity than in a quiet

Train when elevated above them.

This is so remarkable that the famous blind philosopher Dr Moyse could tell the moment he trod upon the floor of a room, or heard a person speak in it whether it was furnished or not.

415. it sounds whether

atmosphere: ~~It is not affected by heat, cold, moisture or dryness in the air.~~ great, or small

~~but always moves with the same velocity.~~ travel with the same velocity. Certain

nonelastic bodies deaden the vibrations

of elastic bodies. It is easy to tell that

the ground is covered wth snow in a

winter morning by the silence w^ich is

perceived in the streets from sounds

being checked as it were by the snow.

a violin emits no sound if the bow be

rubbed w^th ~~fo~~ lard or ~~tallow~~ tallow instead

of rosin. Tapestry & wm Curtains

~~deaden~~ extinguish the vibrations of sound in

a room. — hence the difference of

sound in a furnished & unfurnished

room! ~~[Cause of Dynamics]~~

On the contrary, bodies fitted to

convey sound when in contact with

the body which emits the first vibrat^n

convey it to a greater distance, and ~~then the~~ ~~air the~~ with an accumulation of sound. The ticking of a watch, & even the scratching of a pin, is heard with much greater force at the extremity of a long tract than where the sound is first emitted. The increase of sound is occasioned by the tremors excited, being all in unison w: each other. e.g. a violin.

~~The~~ Sound like light is reflected from the bodies on which it strikes in an angle equal to that its incidence. ~~Its~~ In passing thro' ~~bodies~~ spiral bodies its force is increased by every deflection as we see in ~~the speaking trumpet & Conque~~ the Conque-shell. In the ~~foramen thro' wrong~~ speaking trumpet the sound is collected & preserved & unceasingly

v between air - water - ~~and~~ & light, and the tremors of sound - The force of each is increased by being confined. —

consonant tremors – but in the Conque Shell – there are not only conso= =nant tremors, but a number of reflections, which add greatly to the sound. These reflected sounds travel with so much velocity, that they frequently cannot be distinguished from the primary sound; It is agreeable to observe the analogy

When sound travels 63 or 64 feet and strikes against a body united to re= =flect its vibrations in an an angle equal to its incidence, such as a great hill, or a rock – these vibrations are returned to the ear, & no difference will be perceived between the primary sound & its reflexion which has been called <u>Echo</u>. At 63 or 64 feet, the

a different state of the atmosphere has
[illegible] upon the number of Syllables
[illegible] returned to the ear by an
[illegible] thus we are told 20 Syllables
[illegible] during the Night at a place
called Woodstock in Oxfordshire, and but 17
during the Day.

I am about to deliver upon this Sense
the lecture I fear will be tedious & un-
interesting compared with the Demon-
strations of the Organs of the ear by
the Professor of Anatomy, but a short
Description of them is necessary in order
to enable you [redacted] to
understand the manner in which
hearing is performed, and several of the
phenomena connected with it //

Leeks consists of One syllable — at ~~190~~ of two — and at 190 of three syllables. & at a greater distance of words, or a larger collection of syllables. The V

Lect: 16

We come now agreeably to the order proposed, to speak of the structure of the Ear, & of the manner in which hearing is performed. [this part of our]

‡ The organ of hearing is divided into three parts. Viz: the external Ear — & meatus Auditorius.

2 The Cavity of the Tympanum.

3 The Labyrinth.

I need not detain you ~~[illegible]~~ long in naming the parts which compose the external ear. They are the Helix — the

Antihelix – the Concha – the Tragus – the Antitragus – and the Lobule of the ear. The design of the external ear is to collect the rays of sound and convey them into the meatus auditorius. – Its form, and the matter of which it is composed, are admirably contrived for this purpose. In its natural or savage state, it projects much further from the head, that it does among civilized nations, owing to the early compression of caps in infancy, and of wigs – and wigs in more advanced life. – It is this projection of the ear, that Indians hear so much better than civilized people – a circumstance this ch.

gives them many advantages over us in hearing & speaking. The flat figure of the external ear, may be remedied by raising the helix & antihelix. One hand, the hearing trumpet may be rendered more distinct. It may be made still more distinctly resounding the ear with the hollow of the hand. In this manner Dr. Franklin informed me that he once knew a man deaf himself in company from a moderate degree of deafness. — The ~~[illegible]~~ ~~[illegible]~~ ~~[illegible]~~ number of divisions in the external ear is happily contrived to collect the greatest quantity of sound ~~[illegible]~~ and to converge it by reflections from bodies which are unit similar

vibrations. The cuticle, cellular substance of the external ear, while it is competent to these vibrations, is nevertheless so soft as to prevent cusp in these vibrations. That the external ear serves the important purpose of collecting - reflecting - and converging the rays of sound, we infer from the diminution of the power of hearing by its loss.

In many animals the external ear is moved with great celerity by a number of muscles fitted for that purpose. But the facility & velocity with which the ear is moved in the direction of sound by means of the muscles which move the head in the human species,

renders such a motion in our ears unnecessary. There have been instances however of men who have possessed power of moving the ear by means of the muscles which are attached to it. — It is said the celebrated Albinus possessed this power, & Dr Monro used to mention in his lectures an example of the same kind in a student of medicine who formerly attended the lectures in Edin.

The meatus auditorius begins at the Tragus & Concha. It is wholly cartilaginous in Infants, but becomes partly bony & partly cartilaginous in Adults. It is wider at its two extremities, than in its middle. over its whole surface is spread a thin sensible

membrane, covered with epidermis, and affixed to the lower part of the meat.: and.: by means of cel:=lular membrane. In this cellu:=lar membrane are numerous little glands which secrete a yellow wax which by its viscidity & bitter taste is said to be intended to defend the internal part of the ear from insects and flies. In a grove of a bony ring at the extremity of the meat.: and.: and connected with the os petrosum (or the stony bone, so called from its early & peculiar hardness, being 10 times more so than any other bone in the body) is fixed a membrane in an obliquo direction

This membrane is said to contain a small opening in it which communicates to the meat: Qued: This is infered from tobacco smoke being blown thro' it by means of a passage to be mentioned presently from the mouth. But I suspect this always occurs from the rupture of this membrane. It is true the hearing continues in these cases afterwards, & so it does Dr Monroe says after several of the little bones of the tympanum are eroded, & discharged by Ulcers. Its thus the kind provision of the Author of Nature to preserve & perpetuate the invaluable Organ of hearing. —

called Membrana Tympani. It is nearly horizontal with the earth because the greatest number of sounds that affect us come from below it.

It is of an oval shape - convex below the middle towards the Concave of the Tympanum, & concave towards the meat: aud:, & convex above the middle, & concave towards the hollow of the Tympanum. It is said to consist of six lamellæ or plates, for anat: of which see Anatomical Writers. It is however very thin. Its fabric - situation - & exquisite sensibility qualify it in a peculiar manner to receive & convey sounds into the internal ear.

+ The same accommodation not only of the inner, but outward structure of the ear to the direction of sounds is observed in many animals besides man. In the owl which looks down from the limb of a tree for its prey, the ear projects more above, than below — In the pig which looks up to the chimney for its prey — the greatest projection of the ear is downwards. In the polecat it projects to receive sounds before it + and in the hare ~~[illegible]~~ ~~[illegible]~~ directed backwards, so as ~~[illegible]~~ — the ear is ~~[illegible]~~ to receive the lightest impression of sounds from behind it — a quarter from which its danger & death are chiefly derived. But to return. The membrana tympani in the human fœtus is ~~[illegible]~~ Re

The fenestra ovalis is ~~[illegible]~~ said to be conveyed distinct sounds to the sensorium, while indistinct sounds are conveyed only by the fenestra rotunda. The organ of hearing from this you see is two fold. One part serving to convey simple sounds, & the other to distinguish them, or if I may be allowed the expression to secrete words ~~[illegible]~~ from them.

This 2nd part wch I named, consists of the Cavity of the Tympanum, so called from its resemblance to a Drum. It lies in the Os petrosum. It is irregularly round, and its length is greater than its depth. It is surrounded before, by the membrana tympani and behind, by a bony Septum of the Os petrosum which separates it from the 3rd or inmost cavity of the ear. The Septum is perforated with two holes which are named from their figure fenestra Ovalis & fenestra rotunda. the bony space between these two windows is called promontorium. It divides the Tympanum into two parts.

In the superior & anterior cavity of the beginning Tympanum, we find the of the Eustachian tube which after perforating the os petrosum passes, gradually enlarging, till it ends in a small pouch behind the soft palate near the external wing of the Pterygoid process by an oblique large orifice. This is the orifice, the pituitary membrane of the nose which lines the internal surface of the tube, enters the tympanum. This tube is always open. Hence the air passes freely into the tympanum, & humors distill easily from the tympanum into the mouth. — The presence of air in the Tympanum is

It is necessary further that it be admitted frequently as well as constantly thro' the Eustachian tube, Otherwise it would soon become of a different quality as to moisture & Dryness = Density & rarity from the air which comes in the sounds into the external ear; the consequence of which would be, we should not be able to hear sounds as they occur in the external air. hence, when this tube is obstructed by a cold the entrance of fresh air prevented every day, the sense of hearing is impaired or altered.

— The entrance of this tube is guarded by several small muscles which contract it in the act of swallowing. When

necessary to perfect hearing.

Within the Tympanum are four little bones, the names of which are taken from their figure. They are called Mal-=leus - Incus - Os Orbiculare & Stapes. They are involved in moisture which serves to render the above mentioned the two windows in the tympanum. It is supposed the use of the by Chordae that the Stapes is to open or close the fenestra Ovalis according to the greater or less acuteness of sounds. All the above four bones are connected with each other.

The last part to be mentioned belong=ing to the Tympanum is the Chorda Tympani. It is a nerve which descends thro the middle of the internal surface of the membrana Tympani. It arises from the Dura

these muscles are destroyed as something happens in the venereal disease, the aliment is swallowed with painful noise, & instances have been known of its being forced thro' the tube into the tympanum & thro' the ruptured membranum tympani external ear. — The Eustachian tube is said to afford a passage for sound when the mouth is open - but this is not the case, as may easily be proved by putting a watch in the mouth in such a manner as not to touch the teeth. No sound or ticking of the watch will be heard.

matter of the Auditory Nerve. This
Cord is supposed to be the medium
of communication of the ear.
The whole Tympanum may be consi=
=dered as only the Antichamber of the
peculiar Organ of hearing. It is admirably
formed for this purpose; It encreases
the sound by its drum like form.
The membrana Tympani regulates the Quan=
=tity & force of the rays of sounds
the air & bones in the Tympanum
convey it to the two Windows
this which it is conveyed into the
1st part I mentioned called from
its numerous windings the Labyrynth.
It consists of three parts viz. Vestibu=
=lum - three semicircular Canals,

of the cochlea. —

The vestibulum is a round cavity in the os petrosum behind the tympanum. It is lined with a soft nervous membrane, but in such a manner that a fine vapor is insinuated between it & the bone. It communicates wth the tympanum by means of the fenestra Ovalis, & there are besides five orifices from the 3 semicircular canals, & several openings for blood vessels & nerves wch open into it. The cavity of the vestibulum is filled with water by a canal which arises from a transverse fissure of the Dura mater. It is called Aqueductus Vestibuli.

The three semicircular canals lie posteriorly and superiorly in the os petrosum. They are lined with periosteum & filled with a nervous pulp, between both of which a moisture is interposed.

The Cochlea is situated anteriorly in the os petrosum, before the semicircular canals, but in such a manner that its base is turned backwards, but its apex forwards & outwards. It is formed of two hollow windings like a snail's shell. A canal extends thro' its whole length, & is perforated in its base with numerous holes. It is divided by a septum (called lamina spiralis) into two semicanals,

bony part of the

The system was absolutely necessary, that the cords which are attached to it might resound — for musical cords when fastened to soft bodies emit no tones. —

called Scala or winding stairs. The internal posterior Scala terminates in the fenestra rotunda & is called Scala tympani. The anterior opens into the vestibulum, & is called Scala vestibuli.

The Cochlea is constantly filled with water by means of a canal conveyed to it from the cavity of the Skull, & perforates the os petrosum, & ends in the Scala tympani, near the fenestra ovalis. It is called Aqua ductus Cochleae.

Tho' every part of the Cochlea are distributed nervous fibres from the pair of Nerves. Those parts of the Nerves which go to the Cochlea are called portio mollis.

It is here that Speech is formed as it were out of Sound, — and it was by an imitation of one part of the Labyrynth Viz the Cochlea, that Dyo=
=nisius the tyrant formed his prison
this whose spiral windings he distinct=
=ly heard the smallest whisper that came from his prisoners.

The ~~sense~~ sense of hearing is said by Mr Lelat to be seated in the ~~p~~ third division of the organ of hearing, consisting of the vestibulum - $\frac{e}{y}$ 3 semicircular canals - & the cochlea. They are to the other parts of $\frac{e}{y}$ ear what the retina is to the coats & humors of $\frac{e}{y}$ eye. V

From this minute ~~[illegible]~~ account of the structure of the ear, you see that it is formed upon principles which were laid down formerly, in such a manner as to collect - to reflect - to increase - or propagate - to convey - ~~[illegible]~~ to moderate sounds so

The Vibrations which produce these sensations are all subject to the laws of musical sounds, formerly mentioned. E.g. tones are conveyed only by means of cords, or bodies which emit vibrations that are related to each other, what are called consonance, by degrees — 5ths or 3rds — so that hearing may be defined to be an harmonical vibration or trembling of the ear. The membrana tympani is extremely useful for this purpose. By means of the muscles of the malleus it is relaxed or stretched so as to accord with a numberless variety of sounds, so great as almost to elude calculation. There are some sounds so great or so small as not to be perceived by us. The reason is, they cannot find a consonant cord in the spiral lamina of the cochlea. Mr. Hopkinson's case — has sign. Clifh. not [illegible] —

as produce the sensation of hearing in the Mind. V

The progress of Sound is indeed circuitous, and the number and combinations of the component parts of the ear not only oppress the memory, but overwhelm the imagination. But they use all useful. — without all of them the Ear could not have been a perfect musical instrument, or have vibrated nearly all possible Sounds. In children the hearing is dull for some months from a quantity of mucus which lines the membrana tympani. This is kindly intended to prevent their tender organs from being injured by too forcable sounds. It is remarkable that the bones and other parts of the ear are as large in

I shall illustrate this remark by a striking example. There is a lady in this city who can hear only sounds of a particular kind. She can hear the ticking of a clock, but she cannot hear the beating of a drum. & she can hear the noise made by thrusting a pin thro a piece of paper, but she cannot hear the noise made by the firing of a Cannon. The ~~[illegible]~~ vibrate with the clock & the pin ~~[illegible]~~ but is ~~[illegible]~~ does not with the Drum & the Cannon.

Story of Rosa, & the bells.

from p 53 of Wm. Jones book

Again, a gentleman from Mexico who attended the lecture ~~[illegible]~~ in 1810 ~~[illegible]~~ informed me that he ~~[illegible]~~ witnessed the following incidence that he went when a boy, into a church in that city, at a time when twelve large bells were ringing in it. The wife of the man who had the charge of the bells lived in a room adjoining them which communicated with the belfry by means of a small window. While the bells were ringing the boy ~~[illegible]~~ became noisy, playful in which ~~the woman~~ in his ~~[illegible]~~ to the window, adjoining room. and commanded the boys to be silent, or to depart from the belfry, for that they made such a noise she could not hear what was said in her family. Here we see the spiral lamina of the cochlea vibrated with noise, yet not bells.

[V. It remains only to be in speaking of the structure of the ear, to take notice of the distribution of a part of one of the Auditory nerves to the eyes – the organs of speech & the heart, and of the wise purpose for which it is intended. It serves to promote a quick consent & cooperation between hearing, speaking & feeling. It is particularly useful to protect us from sudden & unexpected evil which approaches us in the form of sound, by disposing the heart to feel, & the eyes to proclaim the danger, & thus to dispel that evil, or to obtain the helps of our friends]

V The ear is of more importance to us than the eye as spiritual beings inasmuch as we acquire most religious ideas thro' the ear. – Words beget ideas in writing – visible – not audible ideas guide the hand] Hartley.

Children at five months old as in Adults.

We acquire our knowledge of the directions of sounds only by experience. Hence we observe Children when spoken to for a while, turn their heads in every possible wrong direction, before they hit upon that which is most favourable for the reception of sound. — We learn the nature of sounds likewise only by experience. Of this Dr Reid informs us of a striking proof. He tells us that he was once suddenly terrified as he lay in his bed, and heard a violent ~~[illegible]~~ which led him to rise ~~[illegible]~~ more than once from his

The deceptions of Ventriloquists are founded upon this nicest & exquisite delicacy of ear whereby they acquire a knowledge of the specific sound which a voice produces in all the different directions it can assume in a room. The voice of the Ventriloquist is always an artificial one & hence it is not recognized, nor associated with his person. It is not in this case only that new sounds in which there is the want of experience to inform us of their direction, deceive the ear. The nature of the noise of an Earthquake is generally derived by different people from two or three different, and sometimes opposite quarters. The same thing takes place the first time we hear birds & beasts are heard in the woods.

bed, and to open his door to see if any body knocked, nor did he discover for some time that the noise he heard was occasioned by the violent palpitation of his heart brought on by fear. The Dr. had never had that sensation before. —

Hearing is not an independent sense. It owes something to the nose. Hence we hear better after sneezing, for by this convulsive motion, the Eustachian tube is cleansed of stagnated fluid, and a more easy passage is made in it for the entrance of

It is remarkable, that hearing is more imperfect, when one ear is only moderately impaired in its capacity of hearing, than when it is ~~cap~~ incapable of hearing any thing. The imperfection of the unsound ear confuses the sound one.

fresh air (corresponding with the external air) into the Tympanum.

2 — It is indebted to the eyes. Hence we hear best when we look steadily at the person who speaks to us, but if the sense of hearing be impaired, this aid from the eyes is necessarily sacrificed to the greater advantage of filling the whole of the external ear with the rays of sound; and hence we observe that deaf persons always turn their side face or one of their ears, towards the person who speaks to them.

3rdly The sense of hearing is indebted to the mouth. Hence we hear best with

tube. It is probable hearing may be encreased by both these causes, but I am disposed to ascribe it chiefly to the meatus auditorius, or that passage which admits air into the ear, being widened by the depression of the two condyles of the lower jaw.

the mouth open. Both poets & painters have borne testimony to the truth of this observation. Shakespeare describes his Blacksmith receiving his "Taylors" news with a gaping mouth. & Leonardi paints a country congregation listening to their parish minister with the same position of the lower jaw. The hearing is more acute in this case when the breath is suspended. — When the mouth is open, — more sonorous rays are conveyed to the ear than when it is shut, — this has been ascribed to the communication of substance, particularly the teeth, and (when we cease to breathe) to the entering air more easily, this by Eustachius.

V I have before mentioned the translation of the senses of touch, taste and smelling. The sense of hearing in the manner has sometimes been translated into sight in Dr Boerhaave, nephew to the illustrious Physician of that name. Fishy seems to hear in the same manner. Some Deaf persons are able to distinguish difference of sounds without being able to understand the difference of words. Dr Fuller mentions as a proof of this, the case of a man who could always distinguish the sound of a Drum from all other sounds by its producing a pain in his belly. The following curious paper shows that all the senses may be translated in the same person. I wish it to be attended to, for it opens a wide field for explaining many phenomena in the history of diseases.

Extraordinary Woman.—The Paris papers recount particulars of a woman in the neighbourhood of Lyons. The circumstances of her case have astonished the philosophers,

~~[illegible] the purpose formerly [illegible]~~ — That the teeth and bones of the jaw & head convey sound from the mouth has been proved by many experiments. Even deaf ~~[illegible]~~ means of speech have been conveyed by these means thro' the ear to the mind. This method of imparting knowledge was ~~[illegible]~~ introduced in Germany by a young lady who was deaf, entering ~~[illegible]~~ a time ~~[illegible]~~ by learning with her teeth accidentally upon her sister's harpsicord while she was playing. V — It is remarkable that many deaf people hear perfectly well in riding in a carriage over

Extraordinary Wonder.—The Paris papers recount prodigies of a woman in the neighbourhood of Lyons. The circumstances of her case have astonished the philosophers,

and left her no ere in with men unaccustomed to scientific reasoning. Learning hesitates, because it wants principles to explain;—Ignorance decides at once, because it knows not the variety of undiscovered principles which exist.

The case of this woman is, that of a confusion of all senses—of seeing, smelling, hearing, touching, tasting. The quality of one sense is inferred to another; there is a kind of organic confusion and substitution; the eyes do duty for the ears, the taste for the eyes, and the touch for the taste.

A very learned physician, a writer in the Journal de Santé, gives an account of having visited this woman at Lyons:

"To believe in apparent impossibilities (he says) is often the necessity of men of science; but it is their good fortune also to discover that the world contains many more miracles than is first imagined, and that nothing is impossible, as referred to the Omnipotence of the Deity, and that impossibilities are much rarer in the combinations of human life than the vanity of science will acknowledge.

"This woman, whom I visited, and to whom I presented several sorts of medicines, powders, simple compounds, and many other substances, which I am convinced she never saw before, told me their several tastes, as nearly, and with as much precision, as taste could pronounce. She described them, indeed, with astonishing exactness, and frequently when my own palate was confounded.

"Her eyes were tightly bound with a thick bandage, and I drew from my pocket several sorts of silk ribands, and those that differed in the original colours she immediately told me. It was in vain to attempt puzzling her; she made no mistake; she passed the ribband merely through her hand, and immediately decided on its peculiar colour. She could, in fact, discover the quality of any thing by the touch or taste, as accurately as I could with my eyes.

"The organs of hearing were then closed as well as the contrivance of stopping the ears would answer the purpose. I then commenced a conversation with a friend in the apartment, and spoke in an almost inaudible whisper. She repeated, with great power of memory, every word of the conversation. In short, I came away a convert; in other words, I believed what I had seen. A Philosopher knows the fallibility of the senses; but he should know likewise that science ought not to reject because it cannot have demonstration. We [illegible] and the power of mi[illegible] aimost all the [illegible] of [illegible]. Ignorance denies [illegible] it may not understand; science endeavours to comprehend, and when it cannot, it submits to the senses."

TAKE NOTICE.

THE Creditors of SHANNON & POALK are informed, that the term allowed for them to accept the assignment of said Shannon and Poalk, and grant a discharge, will expire on the first of March ensuing, after which period, they will be barred the benefit of the property assigned; and those who wish to take the benefit of the assignment, will please call on

John Fries,

Corner of Market and Third-streets, or

William Shannon,

No 16, Market, near Fifth-street

feb. 24 dtM1

REMOVAL.

The subscriber informs his Customers and the Public, that he has removed his Grocery Store, and

COFFEE MANUFACTORY

from No. 455 north Second-street to No. 198 south Fourth-street;

WHERE he means to carry on the Business of preparing COFFEE, as usual; the quality of which may be relied upon to exceed any that has been offered for sale in this city. To prevent imposition, his name, place of residence, and price, will be marked on every package.

Henry Barrington.

☞ Orders from the City or Country will be punctually attended to by applying as above; or to Mr. Joshua Saltonstall, at the corner of Second and Coates-street, Mr. Charles Barrington, No. 216, Market-street, or Mr. Richard Barrington, at the corner of Mifflin and Front streets, Southwark.

TO LET, a large room, which has been occupied as a Dancing Room and will make a very convenient School room, apply as above.

dec. 11 w3t

FOR SALE,

ALL THOSE FOUR HANDSOME

Three Story Brick Houses,

SITUATE on the south side of Chestnut street, between Seventh and Eighth streets, as hereafter mentioned.

No. 174, containing in front 23 feet (or thereabouts) by 43 feet deep, the lot extends to the depth of 145 feet to a private 6 feet alley, on which is erected a Back Kitchen, House and Stable.

No. 182, containing in front 23 feet by 44 feet deep, with an octagon in the rear which extends 6 feet further, the lot is 145 feet deep to the aforesaid alley.

No. 1[illegible] containing 23 feet front by 44 feet deep, with an octagon in the rear, similar to the last above, the lot extends 145 feet to the alley.

No. 1[illegible], containing 23 feet front by 44 feet deep; the lot extends to the alley aforesaid.

Also, a vacant lot of ground on the south east corner of Chestnut and Eighth streets, containing in front on Chestnut street 22 feet, and in depth 100 feet.

Also, one other Lot adjoining the above, containing 22 feet 4 inches front by 100 feet deep.

For particulars please to enquire of the subscribers.

William Ashbridge,
Samuel Williams, junr.
John Richards,

Assignees of William Hamilton.

dec 23 tuthsf

FOR SALE,

A [illegible]

In persons who have been long exposed to a great noise, the membrane ~~of the~~ relaxed ~~tympani becomes so~~, that it cannot stretch itself into a sufficient degree of tension to receive small tones. This is the case in a more especial manner with millers. — Hence among the vulgar when you speak to them too loud, a voice — they tell you — "that they were not born in a mill". — The inhabitants of the neighbourhood of the falls of the Nile are unable to hear when they remove beyond 2 reach of ~~its~~ their noise. There is a gentleman in N Carolina

stones or rough roads. This was the case Sir Jno Hawkins tells us with Dr Johnson, & he adds further upon the authority of a Dr Pope the history of a Lady who would hear only while a Drum was beaten before her. These sounds appear to act only by giving more tension to the membrane of the ear so to enable it to receive sounds which would otherwise be lost upon it.*

There is an intimate connection between the ear and the human voice, & the ear is the sole judge of the strength of the sounds uttered by ourselves — hence we observe deaf people to loose their perception of the strength of their own voices, & to speak lower than usual.

Who can hear distinctly only in a room where there is either vocal or instrumental music.

The extent and correctness of hearing is much encreased by certain diseases - especially where they affect the brain. of this more hereafter.

I said formerly that the ears are more faithful than the eyes in retaining knowledge acquired by them. Another reason besides that of Association of ideas may be given for it. we acquire a knowledge of the objects of sight instantaneously - but not so - the knowledge of the objects of hearing. Voices & words are acquired slowly & with difficulty in early life, and hence they take a stronger hold of the ear & the mind, than objects of sight take of the eye & mind

I said in speaking of vision, that from ~~some~~ a defect in the organization some people were incapable of ~~seeing~~ distinguishing certain colors. The same thing may be said of the sense of hearing.

=. The sense of hearing like the other senses is subject to the disease I have called error sensus. Impressions sometimes ~~[illegible]~~ convey false sensations to the brain, from the same causes ~~[illegible]~~ that were mentioned under the other senses. A certain Neil a patient in the hospital in Nov 25 1809 ~~[illegible]~~ furnished a striking instance of it. He was afflicted with vertigo & deafness, but he heard constantly the chirping of a bird. He says now this was produced by an impression from another sense acting ~~[illegible]~~ upon the ~~[illegible]~~ = nerve or nerves that were moved under the stimulus of ~~[illegible]~~ that noise by a bird.